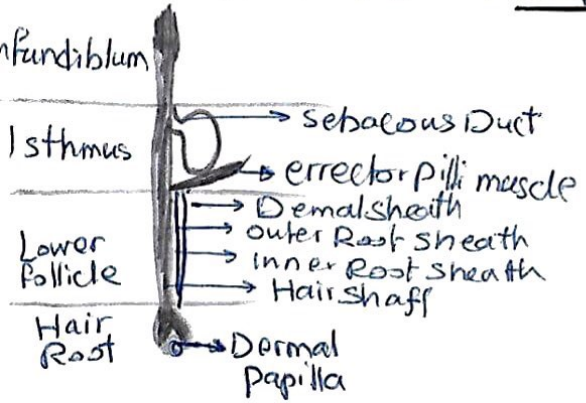
Hair

Amylee

• Anatomy of Hair:

Ⓐ The all Cutaneous Surface → populated By Hair Follicles → except → palms, soles, dorsal terminal phalanges of digits, glans penis, mucocutaneous Junctions

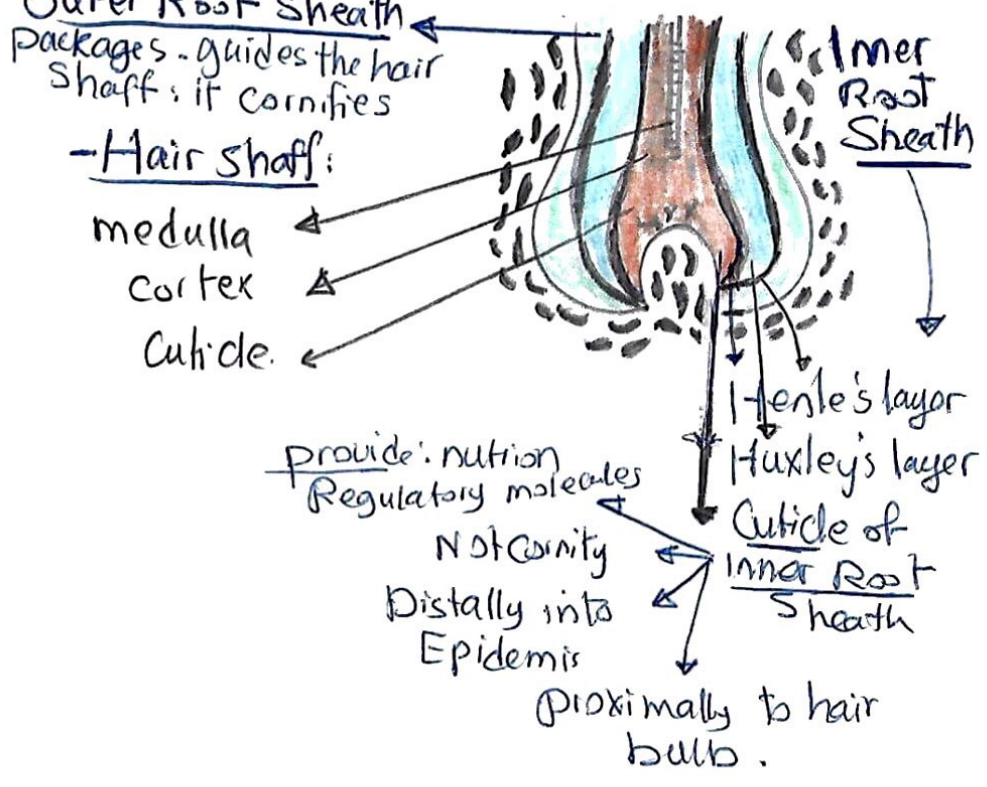


Ⓐ Structure:

1. Infundibulum: lies Above the entry of Sebaceous Duct — • merges & the surrounding surface epidermis
2. Isthmus: • lies : inbetween the point of entry of seb. Duct and point of attachment of arrector pili muscle.
3. The Lower Segment:
   - From: The point of attachment of arrector pili muscle to → Base of follicle
   - Divided to: → Suprabulbar (stem)
     → bulb; ends at Adamson's fringe: where cells of future hair Loss their Nuclei and Begaun to cornify

• Components of follicular bulb:

From out → in:



Outer Root sheath: packages. guides the hair Shaft; it cornifies

Hair shaft: medulla, cortex, Cuticle.

Henle's layer, Huxley's layer, Cuticle of inner Root Sheath

provide: nution, Regulatory molecules

Not Cornify

Distally into Epidemis

Proximally to hair bulb.

[1]

• Pigmentary unit of Hair Follicle:

⊛ Melanocytes → Differ from those of Epidermis:

- Display longer dendrities
- Lower melanocyte : Keratinocyte (1:1 - 1:4)
- UVB light Not of major regulatory importance
- Hair follicle melanocytes → above and around the upper 1/3 of Dermal papilla
- Transfer - eu - pheo - melanosome → to Differentiating hair follicle Keratinocytes in the pre cortical matrix
- Regenerate from melanocyte stem cells in Hair germ During anagen.
- Hair - Shaft pigmentation:
  - Dark hair → predominance of Eumelanin
  - Blond / Red Hair → pheomelanin

• Types of Hair:

① Lanugo: Fine - Soft - unmedullated unpigmented Hair → Covering the fetus prenatally

② Vellus: Fine - Soft - unmedullated Hair Covering most of Youngsters

③ Terminal: Long - coarse - medullated - pigmented Hair, in Adults: eyeBrows eyelashes scalp - beard - axilla

* with the onset of puberty → prepubeital Vellus Hairs → Become → Terminal Hairs
* During life Time → hair follicle may generate all three Types of hair
* A Hair follicle in the scalp → initially produce → Lanugo hair later → terminal hair finally → Balding states it produces Vellus Hair

• Hair Cycle:

- D.f: Autonomus - rhythmic → Transformation of → fully Developed hair follicles → Through phases of
  - → Regression
  - → growth
  - → Resting
- Hair Cycle clock" The autonomus molecular oscillator system That → dicatates hair follicle cycling around follicle.

- in the Hair Cycle: 4 stages:

① Active (Anagen) stage.
② Involuting (Catagen) stage:
- Involution of Lower 2/3 of hair follicle. By massive keratinocyte apoptosis
③ Resting (Telogen) stage:
new Hairs starting to regrow.
④ Exogen:
- Active hair shaft shedding

* in human scalp → anagen stage → takes 3 yrs
Catagen stage → 3 weeks
telogen → 3 months
* Average of scalp growth = 0.35 mm /day.
* The effect of testosterone (T) on hair growth is mediated By: it's more potent metabolite: 5α dihydrotestosterone (DHT)

T → DHT (By) → 5α Reductase (2 isoforms): - Type I, Type II

- Type I: sebaceous glands + liver
- Type II: - Scalp - Beard, chest Hair follicles, Liver - prostate

* DHT, 5α Reductase activity → ↑↑ in Bald skin
* DHT → temporal scalp Hair Recession
→ Development of terminal Hair on Beard, external ears, Nostrils, Limbs
* Scalp: → contain 100,000 hair follicles.
→ each hair grows for 1000 days.
→ Loses: 100 hair/day.
→ Hair grows Rate: 10 mm/month.

* Androgen dependant Hair:
- growth of Facial, trunk, extremity Hair (male)
- pubic - axillary → (Both sex)
→ clearly dependent on: Androgen from testicular, adrenocortical, ovarian sources in Both sex
- Transformation of T → DHT By 5α Reductase: at androgen Target cells

Basic data of human hair follicles	
Total number	~ 5 000 000 (mostly vellus).
Hair cycle distribution (terminal scalp hair)	• Anagen: 85-90% • Telogen: 10-15% • Catagen: <1%
Duration of hair cycle phases	• Anagen: 2-6 years • Catagen: 2-3 weeks • Telogen: 3 months } *Terminal scalp hair* • There are substantial variations in anagen duration: o Terminal moustache: 4-14 weeks. o Terminal arms: 6-12 weeks. o Terminal legs: 19-26 weeks. o Vellus: 6-12 weeks. • Premature anagen induction is induced by plucking of telogen hair shafts (depilation). • Estrogens prolong anagen. • Thyroxine promotes growth, corticosteroids retard anagen onset.
Number of lifetime cycles per scalp follicle	10-20
Hair shaft production rate (scalp)	• ~ 0.35 mm/day, 1 cm/month. • Hair production is not influenced by cutting/shaving. • Estrogens reduce hair growth rate. • Androgens increase hair growth rate & hair diameter in androgen-dependent sites (e.g. beard).

Trichology terms [1]	
Hair bulb	Lowermost portion of the hair follicle.
Hair matrix	Rapidly proliferating keratinocytes that terminally differentiate to produce the hair shaft.
Club hair	Fully keratinized proximal tip of hair shaft, formed during late catagen and telogen; brush-like appearance; characteristic for telogen follicles.
Miniaturization	Terminal-to-vellus hair conversion (e.g. on the balding scalp during androgenetic alopecia); these miniaturized follicles still display an arrector pili muscle.
Arrector pili muscle	Inserts at the level of the bulge; pulls up hair ('goose bumps').
Bulge	Segment of the ORS, located at the level of arrector pili muscle insertion; major seat of epithelial stem cells of the hair follicle.
Secondary hair germ	Additional seat of epithelial and also of melanocyte stem cells; located between club hair and dermal papilla in telogen hair follicle.
Connective tissue sheath (CTS)	Special mesenchymal follicular sheath that is tightly attached to the hair follicle basement membrane and is continuous with the follicular dermal papilla.
Follicular dermal papilla (DP)	Onion-shaped, closely packed, specialized fibroblast population with inductive and morphogenic properties; hair cycle-dependent fibroblast trafficking occurs between CTS and DP; volume of DP determines size of hair bulb and, thus, hair shaft diameter.
Hair patterns	• Pubic hair: Horizontal (90% of women, 20% of men), acuminate (10% of women, 50% of men). • Diffuse chest hair: Normally grows only in men, after puberty (until 6th decade). • Axillary: Appears about 2 years after first pubic hairs, sparser in Asians than Caucasians; frequently absent in older individuals. • Trichoglyphics: Single, clockwise parietal whirl present in 95% of individuals.

Types of hair [1]

5-ص
6ص

Hypertrichosis

-D.f: ↑↑ Hair growth in Body of non-androgen-dependant Hair
- ε' Normal androgen metabolism.

1 Generalized:

⊛ Hypertrichosis lanuginosa:

Congenital AR
- The fetal lanugo hairs Not Replaced By vellous or terminal Hair
- persist, grow excessively, cover whole Body

Aquired
- Fine lanugo Hair grows over large area of Body Replacing normal skin hair.
- its "paraneoplastic" Syndrome
- associated ε malignant. GIT. Bronchus. Bladder

Congenital
- Generalized.
- ± involve: Ea
- gingival Hyperplasia
- Facial dysmorphism
- Skeletal defect
- mental Retardtion
- other Congenital anomalies.
- maternal ingestion of
  - ↳ MinoxidiL
  - ↳ Diazoxide

prepubertal
- Involve: Face forehead, temples preauricular area proximal extremities
  Back: hair is "inverted fire Tree" Pattern.

Drug induced
- hydantoin
- Diazoxide.
- minoxidiL
- streptomycin
- penicillamine
- psoralen (PUVA)

- Bushy eyebrows
- Low anterior hairline
- DD: Hirsutism
- mild elevation of Total, free: Testosterone

2 Localized:

⊛ pigmented/Terminal Hair Hypertrichosis

5
- ↳ Congenital
- ↳ Prebuberital
- ↳ Drug-induced

1- ⊛ Congenital Localized Hypertrichosis:
1- HAmatomas: melanocytic nevi, plexiform neurofibromat
2- Nevoid hypertrichosis Circumscribed Developmental defect
3- Faun tail: Circumscribed in sacral area. "spina bifida"

2. ✱ Hereditary Hypertrichosis:
- affecting: specific anatomic sites:
  - Cubiti → hairy elbow syndrome
- hairy palm. soles of auricle
- Hypertrichosis of the eyebrows

3. ✱ Localized Hypertrichosis
- in herditary, aquired Systemic disease
- e.g: Hypertrichosis in Sun-exposed area is one of signs of porphyria.
  "porphyria. Cutanea Tarda"
  "Congenital erythropoitic porphyria"

4. ✱ Aquired Circumscribed Hypertri
- After Trauma
- e.g: occupational or Surgical wounds
- After inflammation.
- after long term. Local application of glucocorticoids

✱ Hirsutism ✱

1- D.f: excessive growth of coarse terminal hair in women on androgen-dependent areas of Body.
e.g: upper lip - Chin - cheeks - chest - Lower abd. inner aspect of Thighs.

2- classification:
I) Constitutional or dermatologic
II) Endocrine organ Based: ← Adrenal, ovarian, Pituitary
III) D.t Ectopic Hormone production
IV) Iatrogenic V) Hepatic VI) D.t peripheral
Failure of converting androgens into Estrogens

3- Epidemiology:
affect 5% of women of reproductive age in The general population

I] Constitutional :

Type	Circulating Hormone	clinical
1-Familial	-Normal value (↑↑ end-organ Response to Normal plasmal level of Androgens)	-Generalaized Facial - prolongation of preauricular Hair -No other alterations of the SAHA syndrome -
2- Adrenal persistant Adrenarch Syndrome Adrenal SAHA $	-Mild ↑↑ in DHEA-S	- Thin young women - Feel "stressed" -Central Hirsutism (ant. neck, upper pubic area) - Infense Seborrhea -Nodulocystic Acne. ·FAGA I-II - Oligomenorrhea
3-Ovarian -excess ovarian-androgen relase $ - Ovarian SAHA $	-mild ↑↑ in free testosterone (DHEA-S normal)	- Young women . Obese -Lateral facial and mammary Hirsutism -Intense Seborrhea. -papulopustular Acne -FAGA-I - normal menses Polymenorrhea
4 - Hyper-prolactinemic SAHA $ è Hyperprolactinemia	-slight ↑↑ in prolactin	-Central - lateral hirsutism - Sometime → Seborrhea, Acne, FAGA-I, Oligomenorrhea galactorrhea

II] Endocrine Based-organ

① Adrenal : non-Tumoral / Tumoral

A) Non-Tumoral

Adrenal Hyperplasia

- Congenital Adrenal Hyperplasia CAH
- D.t : Congenital Deficency of one of the enzymes involved in Synthesis of Adrenal Steroids
  - 21-hydroxylase deficency
    95% of all cases
  - 11-β-hydroxylase deficency
  - 3-β-hydroxy-delta-5-steroid dehydrogenase

Hypercortisolism

- Cushing Syndrome
  - Hirsutism
  - Cushing Symptoms :
    - Central obesity
    - moon facies
    - Buffalo-hump
    - Hypertension
    - glucose intolerance
    - purple stria
    - ecchymoses
  - elevated ↑↑ Serum Cortisol

B) Tumoral adrenal Hisutism:

Virilizing adrenal adenoma - Carcinoma

② Ovarian

A) Non-Tumoral:

PCO

- polycystic ovary syndrome
- After Normal menarche
  ↓
  Develop: persistant Oligo or Amenorrhea.

accompanied By:
Infertility

- Acne → 70% of ptn
- Hirsutism → 90%

Hyperthecosis

- PCO But ↑ greater production of Androgens (Testosterone)
- ptn ↑ Signs of Virilization
  - Hirsutism
  - Androgenic Alopecia

B) Tumoral:

- mild relative to the degree of virilization in older
- specially post menopausal women

③ Pituitary ↑↑ → ACTH (Cushing disease)
→ Prolactin

Congenital adrenal hyperplasia

Classic CAH:

- During the first 2 weeks of life: dehydration and electrolyte abnormalities (due to cortisol deficiency); ambiguous genitalia in female neonates, hyperpigmentation of the genitals, flexural areas & palmoplantar creases.
- Precocious pubarche, followed by hirsutism, acne and patterned alopecia.
- Lack of breast development in women and a large penis with small testicles and no spermatogenesis in men

Late-onset (non-classic) CAH:

- Occurs due to partial deficiency of one or more enzymes in the metabolic pathway leading to cortisol production.
- It usually becomes apparent during adolescence or young adulthood.
- Unlike classic CAH, late-onset forms may have manifestations that are subtle and easily overlooked. Women with late-onset CAH may have normal menstrual cycles and normal basal serum hormone levels.
- Stimulation of the adrenal cortex with ACTH is necessary to detect the enzymatic defect. About 80% of the patients will present with polycystic ovary syndrome (PCOS).

Cryptic CAH: Described in family members of patients with CAH:

- Same biochemical alterations as the affected individuals.
- No clinical manifestations.

✱ Hirsutism of Adrenal origin:

1- Central Hirsutism (Cant·neck to upper pubic)
2- Female androgenitic Alopecia (FAGA, Ludwig I-III) or male pattern Androgenetic alopecia
3- Signs of virilization
4- Thin

✱ Hirsutism of Ovarian origin:

1- Lateral (Cor neck, Breast)
2- FAGA I-II
3- Menstrual Disorders
4- Obese.

III D.t Ectopic hormone production:

- Ectopic ACTH secretion By:
  - lung Carcinomas
  - Carcinoids
- production of- B-HCG By:
  Chorio Carcinoma.

IV Iatrogenic hirsutism:

- Due to: Anabolic steroids Adminstrate to women
- once steroid Discontinued → Hirsutism improves

V] Hepatic Hirsutism:

- with Liver Disease: ↓↓ in Sex Hormone-Binding globulin (SHGB).
- more free testosterone → Conversion to DHT

VI D.t peripheral Faliure in Converting Androgen in to Estrogen: ↑↑↑ free testosterone.

*HAIR-AN syndrome:

HyperAndrogenism. Insulin Resistance, Acanthosis Nigricans

4* DD:

Defeminization	Virilization
- Acne - Female androgenic Alopecia (FAGA) - Menstrual alteration (Oligo) - Breast atrophy - Loss female Body contours - Rugosity of vaginal column ↓↓ - Infertility	- Hirsutism - Female androgenic Alopecia of male pattern (FAGAM) - Amenorrhea - Muscle mass ↑↑ - Clitromegaly - Coarsening of Voice

5-Evaluation of ptn: 1-Histry 2-examinfion 3-Lab invest

① History :- • Age of onset • rate of progression • medication • Virilization Symptoms • menstrual • family • pregnancy

→ if History of: Rapid progression, Sudden onset of Hirsutism and Virilization → Neoplastic Source.

② Examination: -

1. Degree of hirsutism By:
   - Ferriman, Gallwey Scoring system
2. Signs of virlism:
   - Acne
   - frontal balding
   - Clitoromegaly
   - ↑↑ muscle mass
3. if suspect Tumor of ovarian or adrenal, ↓origin:
   - Sonography
   - CT
   - MRI of abd, pelvis.

③ Laboratory evaluation:

- Determine of Serum level of

A Testosterone • DHEA-S • FSH • LH
17-hydroxyprogesterone • prolactin:

1- Serum total Testosterone > 200 → androgen-producing Tumor

2- marked elevation DHEA-S > 700 → adrenal Tumor

3- phè PCO • modest elevation in testosterone and DHEA-S.
• elevated level of LH • normal or Low FSH

4- LH/FSH Ratio > 3:1

$$\text{Free Androgen index (FAI)} = \frac{\text{Total T (nmol/L)}}{\text{SHBG (nmol/L)}} \times 100$$

- normal value = 7-10
- more useful in: mild-moderate hirsutism = Diagnosis of mild androgen excess as a Cause

5- Elevation in Basal plasma level of 17-hydroxy-Progesterone = CAH

- Lower level < 200 ng/dl ⇒ exclude the disease
- mild elevated 300-1000 ⇒ Require ACTH stimulation Test

B ACTH stimulation Test:

- 250 µg → IV. of ACTH
- level of 17-hydroxy progesterone measured Before and 1hr After the injection.
- post stimulation values exceed > 1000 ⇒ indicate +ve test result.

C 3α-androstanediol glucuronide:

(3α-Adiol G) its DHT metabolite

- good indicator of: peripheral androgen Action
- its Concentration has No correlation è Degree of Facial hirsutism, dosen't prouide any info
- Androsterone glucuronide → Reflect peripheral androgen Action Better than 3-Adiol

D Dexamethasone Suppression test:

- (1.5 - 2 mg daily By mouth For 5-7 days)
- The pattern of Response of plasma free Testosterone, DHEA-S, Cortisol → Segregates pts diagnostically

6- Treatment:

1 Cosmetic methods:

- Hair bleaching < 6% hydrogen peroxide or 20% ammonia solution
- Shaving - depilation è tweezers, wax, chemicals
- Electrolysis
- Laser (Alexandrite, Nd YAG - diode)

2 ttt of neoplastic Causes of Hyperandrogenism:

(androgen-Secreting tumors - Cushing's)
↳ Surgery ↳ X-irradiation ↳ Chemotherapy

3 ttt of Non-Neoplastic Causes of Hyperandrogenism = Antiandrogens

↳ in women è Acne
Hirsutism - AGA
- Androgenic alopecia
- Hidradenitis suppurative
- premenstrual syndrome
- Fox-Fordyce disease.

Uses
- prostate Carcinoma
- Acne vulgaris
- Hirsutism
- Seborrhea.
- precocious puberty

gluco-Corticoid ① Suppression of Adrenal androgen

1- Dexamethasone 0.25-0.5 mg/d in evening → for 3 months (1st of choice)

2- prednisone 7-5 mg/d → for 2 months
Then Reduce to 5 mg/d → for 2 months.
Then Reduce to 2.5 mg/d → until 6 month
(alternative Regimen)

3- Deflazacort: initial Dose 30 mg/d → 1 month
maintinance dose: 6 mg/d → up to 2 yrs

2 Suppresion of Ovarion androgens :

1- By **oral contraceptives ocp:**

Containing ← estrogen ethinyl estradiol
progesteron-

-It's 1st Line ttt in Hyperandrogenic women desiring Contraception

-Ethinyl estradiol → Stimulate the production of SHBG.

2- **Gonadotropin-releasing Hormone (GnRH) agonist: Leuprolide acetate**

Dose :- 3.75 mg/every 28 days for 6 consecutive months → Suppress pituitary and gonadal function → Through Reduction in LH, FSH levels

3- **Triptorelin** (another GnRH agonist) as a therapy of SAHA ovarian ♀

3 Suppresion of pituitary gonadotropin release :

By gonadotropin-releasing hormone agonists :-

e.g: **Leuprolide acetate , Nafarelin**

4 Androgen Receptor Blockades :

a) **Spironolactone** "Aldactone" aldosterone antagonist

-with mild antiandrogen activity

-Dose : 50-200 mg/day → for 6 months

in women è limited disease : e.g : acne only or AGA only

-Drospirenone

= 17-α-Spironolactone derivative with : prognostic, antiandrogenic, antialdosterone like

Dose : 3 mg/day During the 21-day cycle along è 30 µg of ethinyl estradiol → Option for the ttt of : SAHA

- Drospirenone doesn't cause weight gain

b) **Cimetidine (Tagamet) :**

Histamine H2 antagonist 300 mg 5 times/day

c) Cyproterone acetate (CA) Androcur

- Synthetic steroid derivative of 17-hydroxy progesterone.
- It Blocks the Binding of DHT to androgen receptors at the androgen target sites. such as Hair follicle.
- it inhibit gonadotropins Secretion
- Long term therapy → associated è Reduction in Cutaneous 5-α Reductase activity
- Dose: 20 mg - 100 mg daily from Day 1 to Day 10 of the Cycle
- Contraception indicated During Rx D.t possibility of antiandrogen effect on Developing fetus

d) Flutamide 125 - 500 mg/d.

- potent, nonsteroidal, Selective anti-androgen → Block androgen receptor
- used è Contraceptive
- Risk of hepatotoxicity

5 5-α-reductase inhibitor:

"Finasteride" proscar

- Dose: 5 mg/day in AGA
- it inhibit α-reductase inhibitor

"Dutasteride" = more potent reductase inhibitor Than finasteride.

- inhibit Both types I and II 5α-reductase

6 Ketoconazole "Nizoral":

- it inhibits Steroid production
- Dose: 400 - 1200 mg/day

4 Suppression of pituitary prolactin production:

- Bromocriptine = 2.5 - 7.5 mg/day
- Cabergoline = only once weekly

5 Metformin (Glucophage):

- 500 - 850 mg
- used in Rx of Hirsutism associated è Hyperinsulinemia
- may be part of PCOs
- Dose: initial Dose = 500 mg è Breakfast for 1 week then 500 mg è Breakfast + Dinner for 1 wk Then 1.5 mg daily in 2-3 divided doses.

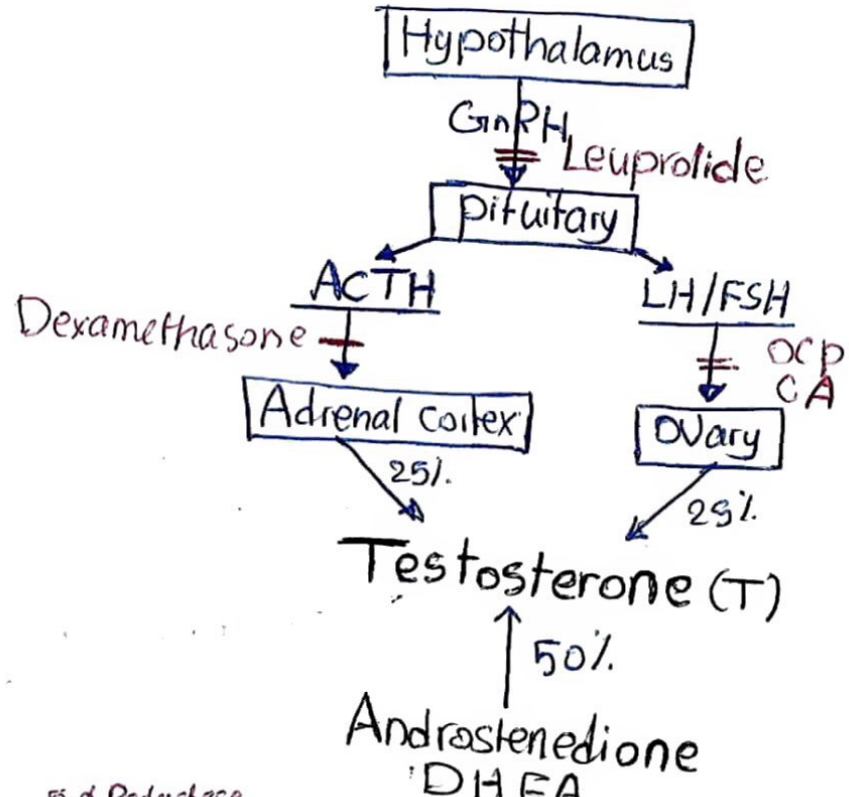
Metformin

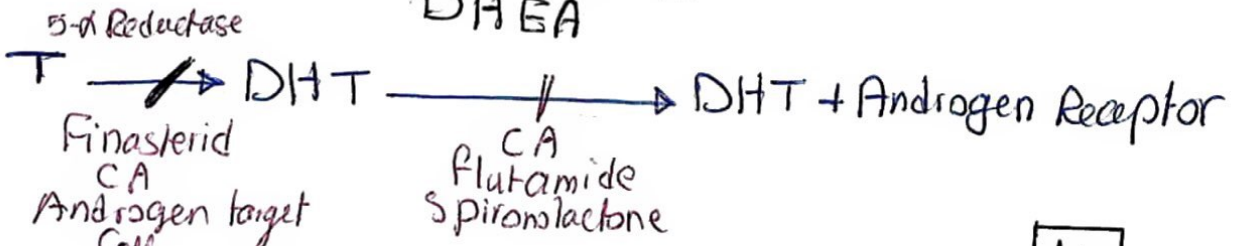
- Biguanide used in ttt of type II DM
- Action:
  - ↓↓ the hepatic glucose output
  - ↑↑ glucose utilization By muscles + adipocytes.
  - as a Result of improvement in glycemic Control → Serum insulin Concentration decline Slightly
    - Thus improving Hyperinsulinmia and its signs
  - platelet anti aggregating effect
  - Anti oxidant effect
- **Use**:
  - Hirsutism - Acne
  - Hidradenitis suppurativa
  - Acanthosis nigricans
  - Psoriasis
- **Side effect**:
  - leukocytoklastic vasulitis
  - Bullous pemphigoid
  - Psoriasiform Drug eruption
  - lichen planus

6 **Topical therapy**: • Spironolactone or its metabolite Canrenone (1-3%)
• Topical eflornithine (Vaniqa) 15%.

7 **Surgical Therapy**: for Ovarian - adrenal tumors

8 **Iatrogenic hirsutism**: Responsible Drug must eliminated





* site-specific Blockage By diffrent Drugs

Differential diagnosis of hirsutism

History & physical examination
Evaluate for symptoms & signs of:
Cushing's syndrome, acromegaly, menstrual alterations, virilization
Review medications, including supplements

Testosterone
(nl = 20-90 ng/dl)

Normal or slightly >100 ng/dl

SHBG ↓
3αAG normal/↑
Free testosterone slightly ↑

Constitutional hirsutism

Ovarian	Adrenal	Familial	Hyper-prolactinemia
DHEA-S nl Δ4A nl/↑	DHEA-S ↑ Cortisol ↑*	Normal analysis	Prolactin ↑

Testosterone levels 100-200 ng/dl

Free testosterone greater (proportionally)
DHEA-S normal
SHBG ↓
FSH ↓, LH ↑
Estrone ↑↑
Prolactin slightly ↑
Pelvic ultrasound

Polycystic ovary syndrome

DHEA-S & Δ4A moderately ↑

CAH	Cushing's syndrome
Cortisol nl 17-OH ↑	Cortisol nl 17-OH nl/↑

Testosterone levels >200 ng/dl

CT scan or ultrasound of adrenal glands & ovaries

Adrenal tumor	Ovarian tumor
Cortisol nl/↑ 17-OH nl/↑ DHEA-S ↑↑↑ Rapid symptoms	DHEA-S nl 3αAG ↑

Dexamethasone suppression test
ACTH stimulation test
CT scan, venous catheterization, etc.

17-OH	17-OH-progesterone
Δ4A	Δ4-Andostenedione
3αAG	3α-androstanediol glucuronide

* If clinical picture is very intense.
SHBG = steroid hormone-binding globulin.
DHEA-S = dehydroepiandrosterone sulfate
CAH = congenital adrenal hyperplasia

Alopecia

- **D.f:** loss of Hair from normally Hairy Regions of the Body = Hair Fall.

- **Evaluation of ptn è hair loss:**

① History: (shedding - Thining)

- **shedding**
  - Lots of Hair comming out each Day
  - over short period (1-2 mnths)
  - e.g: telogen effluvium, anagen effluvium, alopecia totallis
- **thining**
  - more scalp visible
  - less hair than Before
  - But without noticable Hair Fall
  - e.g: Androgenic, Senile Alopecia

- **Duration:** < congenital (since Birth), Aquired
- **Family History:** in hair-shaff disorders and Androgenic alopecia
- **other:** Grooming practices - Hair Dye, Bleaching

② Examination:

✳ **pattern of Hair Loss:**

- **patterned or Circumscribed**
  - area of Alopecia confined to → one or several pations of scalp
  - ↓
  - leaving at least a portion of scalp uninvolved
  - e.g: patchy alopecia areata
- **Diffuse**
  - uniform Reduction in Hair Density over all portions of the scalp
  - e.g: telogen effluvium

✳ **Hair Fragility associated è some Hair-Shaff Disorders:** e.g: Trichorrhexis nodosa

✳ **The scalp Surface:**

- to detect inflammatory form of alopecia or scarring alopecia
- e.g: psoriasis - or histiocytosis of scalp

Can Cause: Dramatic scalp Disease.

③ Investigative techniques:

✱a) Gentle hair pull test:

- 50-60 hairs are grasped firmly Between The thumb and forefinger → firm steady traction is applied
- Normally: <10% of pulled sample Can Be extracted with single pull.
- ↑↑ amount of Telogen hairs → telogen effluvium
- presence of dystrophic anagen Root → Diagnostic of Anagen effluvium
- The ptn should Not wash her hair with shampoo at least **24 hr** Before The Test.
- The pull Test is Normally -ve on the day of shampooing

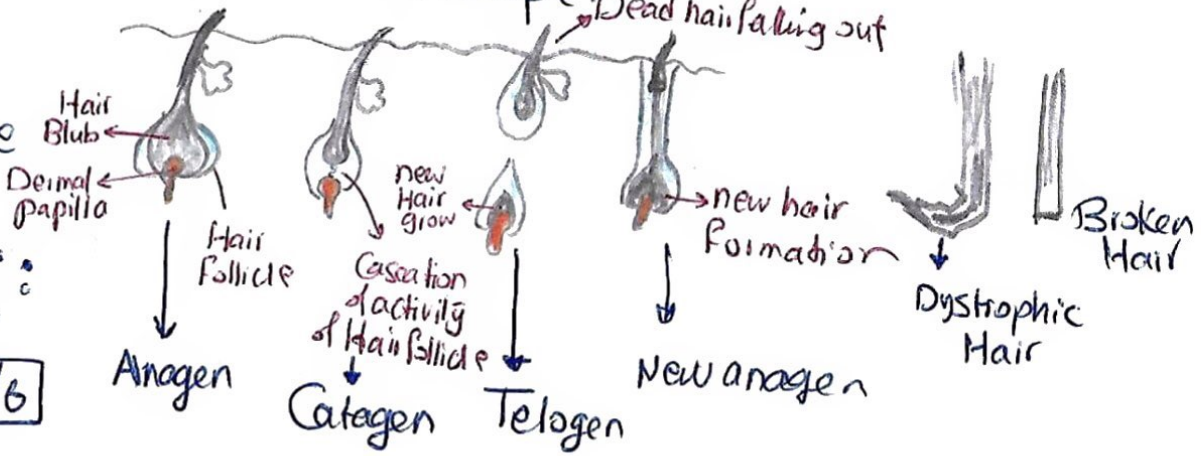
✱b) Forcible Hair pluck test:

(Trichogram)
(Hair root status)

- The proportion of anagen to telogen follicles in the scalp → determined from plucked Hairs at a given point.
- A Bundle of 50-60 Hairs → pulled out all together By: **Rapid tug** with **artery Forceps**

↳ The gripping parts of which have Been Covered with rubber.

- The hair must Not washed for **5-7** days Before.
- The Hair is put immediatly into **petri-dish** → Containing **dampened** cotton
- The Hair **Root** → placed Between two slides in a solution of physiological Saline → examined under x10-30 microscope



- The principle features of Trichogram

هيكتبه عطاء - وصف الصورة

↳ **Anagen hairs**: The Root : Largest at Base. equal Diameter throughout.
- The inner root sheath → present, firm.

↳ **Telogen hairs**: Root : Club-Shaped.
- Lack of angulation.
- Loose Sheath.

↳ **Dystrophic hairs**:
- occur in: pathological Conditions.
- Thin- without Root sheath, taper at Proximal end and Break off here.

★ Normal Trichogram:
- Normally → 85% of the roughly 100,000 hairs on scalp → in Anagen stage
  → 0.5-1% in Catagen stage.
  → 15% in Telogen stage.
- Normally → 25-100 telogen hairs lost/day

★ Unit area trichogram:
- The test similar to Trichogram in tequnique
- it gives more information about Hair Follicle Density, proportion of anagen fibers Hair Shaft Diameters.

c) ✱ Trichoscan:
- Its automated software program
- for analysis of Hair growth.
- Images taken from small analyzed area of scalp.
- Transitional area of Hair Loss Between normal Hair and Balding Region Must Chosen.
- Can Be used for: Long term follow-up and quantification

d) ✱ Time shed-hair-count:
- ptn → Collect and count every shed hair over 24 hr (N = 50-100/day)
- Scalp hair is Brushed for exactly 1min → hairs sheded is Counted.
  ↳ High value > 150 = active hair loss
  Higher number or Lower = worsening or resolution

e) ✱ Global photography:
- Images of vertex-frontal-temporal region
- Used as standard to follow up and Detect clinical changes happen.

F) * Hair growth window :

- to assess the rate of hair growth in pts complain that their hair doesn't grow at all.
- Small patch of scalp (2x2cm) → shaved.
- After 1 week → the hair in this area should be 2.5 mm in Length.
- in pts e: trichotilomania, occlusion of the window may be necessary to prevent Trauma of this area.

g) * Scalp Biobsy :

- Detect presence of inflammation and scarring
- For histopathological evaluation of Cases of Hair Loss → two 4mm punch Biobsy are taken from scalp
- They should be deep enough to reach the Subcutaneous fat as the bulbs of anagen follicle → at this depth
- Specimen → Vertically and other horizental
  - Vertically → examin changes at DEJ and S.C. fat
  - horizental → Show all follicles → detect pathological changes

h) * Dermoscopy :

i) * Lab investigations :

- No Routinly Recommended investigations
- according to history :
  - → Serological test for syphilis
  - → Direct KoH, Culture in T. Capitis

* Results of Hair pull test and pluck test in different Types of Alopecia جدول 25 J 20

Results of hair pull test and hair pluck test in different types of alopecias

	Hair pull test	Hair pluck test
Alopecia areata	Positive at edges of expanding circumscribed patch or diffuse in wide-spread disease; some dystrophic anagen as well as telogen hairs will be found.	The more active the disease, the higher the telogen count will be (can reach 100%) and the more likely the dystrophic anagen hairs will be present.
Androgenetic alopecia	Normal	Normal or slightly increased telogen count in affected area.
Telogen effluvium	Increased numbers of normal telogen hairs.	Telogen count elevated in all parts of the scalp; (>20% suspicious; >25% diagnostic); no dystrophic (pencil-point) hairs present.
Trichotillomania	Both hair pull & hair pluck are normal in unaffected areas	
Traction alopecia		
Non-scarring alopecia in SLE	Numerous telogen hairs can be extracted in a telogen effluvium. Both telogen hairs and dystrophic anagen hairs can be extracted in the anagen effluvium pattern.	In a telogen effluvium, normal telogen and anagen hairs are found and the percent-age of telogen hairs is increased (> 20%). In an anagen effluvium, both telogen hairs and dystrophic anagen hairs are found; normal anagen hairs are scarce.
Chronic cut. LE	May be positive at the periphery or with-in involved areas, negative in normal-appearing scalp.	Increased telogen count at periphery or within involved areas, normal elsewhere on scalp.
Pseudo-pelade of Brocq	Reportedly positive for anagen hairs in rare cases of marked disease activity.	Unlikely to be helpful.
Lichen planopilaris	+ve at the periphery or within involved areas, negative in normal-appearing scalp.	Increased telogen count at periphery or within involved areas, normal else-where on scalp.
Syphilitic alopecias	Expected to be positive for increased numbers of telogen hairs.	Expected to be positive for an increased telogen count (100% in some cases).

1- Cicatricial Alopecia

↔ as a Result of:

Destruction of hair follicles By scar tissue Formed in scalp.
leading to: irreversible alopecia

- **1ry**: the target of inflammation is hair follicle
- **2ry**: follicles are destroyed in non-specific maner e.g Burns - Trauma

→ Pseudopelade of Brocq:

- affect: women more 30-55yr
- Slowly - chronic - progressive irregular defined - Confluent patches of alopecia
- affecting mainly: the Crown or the Back of the head.
- in **Early stage** ↔ patches show mild perifollicular Erythema.
- **Late stage** → smooth, shiny atrophy without inflammation
- with absconce of follicular pores
- Few solitary hairs → persist within the atrophic patches

↔ Causes:

① Congenital or developmental defect:

- Aplastic Cutis - epidermal nevi - Incontinentia pigmenti
- Ichthyosis - Focal dermal hypoplasia
- Porokeratosis - Darier's Disease.
- epidermolysis Bullosa.

② physical injuries:

- mechanical Trauma, Burns, Radiodermatitis

③ infections:

→ Fungal: Kerion - Favus
→ Bacterial: LV - gumma - leprosy - Carbuncle folliculitis - acne necrotica.
→ viral: Hz - varicella

④ Tumor: BCC - SCC - Cylindromas

⑤ CTCL

⑥ Collagen diseases: < DLE / DM, morphea

⑦ Dermatosis of unknown etiology: LP - Graham little S

Pioderma gangrinosum

↔ Histopathology:

① moderate perifollicular lymphocytic infiltrate
② later: The Epidermis Become Thin and atrophic
Dermis: Densely sclerotic
③ Collagen Bundles → vertically to the surface of the skin mark former follicles.

↔ DIF:

-ve or minimal IgM at BMZ

↔ treatment:

1- Intradermal injection of Corticosteroids
2- Antimalarials, Anti-inflamatory Drugs

↔ other Common Causes of Scarring alopecia of pseudopelade Type:

- lichen planopilaris - chronic DLE
- Morphea - Necrobiosis lipoidica.
- Folliculitis decalvans.

29-28

2. Tractional Alopecia

- Biphasic form of hair loss
- Initially: The hair loss is temporary → Hair Regrowth occur
- Then: The condition Behaves like a non-cicatricial alopecia
- if excessive traction: maintained for years → The hair loss Become permenant (End-Stage or burnt-out)
- There also may be folliculitis

Lichen planopilaris (LPP) (Figs 8, 9)

1) Classic	Women>	Pruritic, multifocal or central alopecic patches with follicular hyperkeratosis & erythema at hair-bearing margin.	May be present.	1. Topical steroid ± IL-TAC. 2. Oral retinoid, prednisone, HCQ, topical cyclosporine. 3. Oral cyclosporine, griseofulvin. 4. Antiandrogens as finasteride & dutasteride were recently reported to be effective in treatment of frontal fibrosing alopecias*. 5. Pioglitazone** (an antidiabetic agent).
2) Frontal fibrosing alopecia (FFA) (Figs 10-21)	Post-menopausal	Frontotemporal recession often with classic LPP at hair-bearing margin. Eyelash loss, facial papules, and body hair involvement were associated with severe FFA*.	May be present (eyebrow>).	
3) Graham-Little syndrome	Adults	Patches with follicular hyperkeratosis.	May be present (non-scarring in axillary & pubic areas).	

Clinical				
Entity	**Epidemiology**	**Scalp**	**Non-scalp**	**Therapeutics**
Central Centrifugal Cicatricial Alopecia (CCCA) (Hot Comb Alopecia)	Black women> who use caustic hair care products or using "hot combs" Premature desquamation of the inner root sheath.	Central scalp; non-inflamed, flesh-colored symmetric patch.	Absent	1. Cease traumatic / chemical hair care practices. 2. Topical steroid + oral tetracycline.
Alopecia mucinosa	All ages	Polymorphous dis, e.g. erythematous plaques with patulous ostia, alopecia areata-like, diffuse or complete alopecia, ... etc.	May be present; rule-out malignancy.	For primary form: 1. Topical steroid, ILTAC. 2. Minocycline, isotretinoin. 3. Phototherapy.
Keratosis follicularis spinulosa decalvans (KFSD)	Onset in childhood Congenital	Patchy, follicular hyperkeratosis ± perifollicular erythema.	Present, photophobia.	1. Topical steroid, ILTAC. 2. Isotretinoin.
II) Neutrophilic				
Folliculitis decalvans	Adults	Central scalp>, grouped follicular pustules, military abscesses or hair-bearing margin.	Absent	1. Antibiotic ± steroid. 2. Rifampicin + 2nd antibiotic. 3. Fusidic acid + zinc.
Perifolliculitis capitis abscendens et suffodiens (Dissecting cellulitis)	Black men>	Painful, boggy, contagious dermal alopecic nodules that can spontaneously suppurate, sinus tracts.	Follicular occlusion triad, arthritis	1. Oral isotretinoin, topical isotretinoin + clindamycin. 2. ILTAC, incision & drainage if painful, localized. 3. Antibiotic, zinc. 4. Prednisone, dapsone.
III) Mixed				
Acne keloidalis	Black men>	Occipital scalp, firm red-brown papules, papulopustules, nodules & keloidal plaques.	Absent	1. ILTAC ± antibiotics. 2. Excision (plaque form).
Acne necrotica varioliformis	Adults	Anterior scalp, pruritic, tender umbilicated papules, punched-out crusts, varioliform scars.	May be present (seborrheic areas).	1. Antibiotics ± topical steroids. 2. Isotretinoin, ILTAC.
Erosive pustular dermatosis	Elderly women>	Asymptomatic, crusted purulent plaque.	Absent	1. Topical steroid, calcipotriol. 2. Zinc.

3- Telogen effluvium

- **D.F:** Following stress conditions → many **Anagen** hair follicles enter prematurely into **telogen**
  - → Diffuse shedding of Hair occur 3-4 months after exposure to Stressful event → continue for months
  - → the prognosis is good → unless Stress is repeated.
  - → Spontaneous Complete Regrowth takes place in 6 months.
- **Causes:**
  - ✱ Physiologic:
    - → physiological effluvium of Newborn
    - → post partum effluvium
  - ✱ Injury - Stress:
    - → High Fever
    - → Sever infection
    - → Sever chronic illness
    - → Sever psychological Stress
    - → Hypothyroidism
    - → Major Surgery
    - → Endocrinopathy
    - → Drugs: Retinoids - Anticonvulsants Antithyroids - anticoagulant

- **chronic telogen effluvium: CTE**
  - Shedding hair for Longer than > 6 months
  - Etiology:

Idiopathic	Organic
- self limited - women 30-50 yr - give history of ability to grow their hair very Long in childhood. - marked temporal Recession - No widening of Central Hair parting in AGA	- occure` thyroid disorders - profound iron deficency anemia - acrodermatitis enteropathica - aquired Zinc deficency - malnutrition - liver disorders - chronic Renal failure - Hodgkin's Disease - Syphilis

- **Lab. evaluation:**
  1. Iron deficiency ≤ serum level ferritin 40 µg/L
     - 70 or less in liver disease
     - Related to: alopecia areata androgenic alopecia telogen effluvium
     - Hx of deficency

2 Biobsy:

- normal total number of follicle
- ↓ number of terminal anagen hair
- ↑ number of terminal telogen hairs
- normal number of Villus hairs
- No peribulbar inflammation

- **Pathogenesis:**

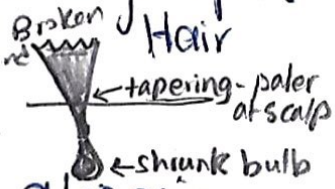
Pathogenesis*

There are 5 types of telogen effluvium based on different phases of the hair cycle:

	Pathology	Occurs in
Immediate anagen release	Follicles enter telogen prematurely.	Acute telogen effluvium (high fever, surgical trauma, sudden starvation, hemorrhage or severe emotional stress) and in chronic organic telogen effluvium.
Delayed anagen release	During pregnancy, hairs remain in prolonged anagen rather than cycling into telogen and postpartum conversion to telogen will result in increased shedding 2-3 months after childbirth.	Postpartum hair loss.
Short anagen syndrome	Shortening of anagen, so club hairs are released 4-6 weeks after the onset of anagen.	AGA and chronic idiopathic telogen effluvium.
Immediate telogen release	Shortening of normal telogen.	Using drugs such as minoxidil.
Delayed telogen release	Occurs after a prolonged telogen followed by transition to anagen.	Occurs seasonally in some humans.

4 Anagen effluvium

- **D.F:** Acute - within few days
  Extreme alteration of growth of the majority of anagen follicles ⇒ Dystrophic Hair (exclamation hairs).
  → Fragile - prematurely shed.



→ Resulting in: Acute - extensive alopecia

Trichogram: normal % of telogen hairs with Reduction of normal anagen hair, Dystrophic Hair

Causes: 1 alopecia areata 2 Drugs → cytotoxics / anticoagulan
3 Radiation therapy

5- Androgenic Alopecia

- **D.f:** progressive transformation of Terminal follicles into vellus follicles
- **Induced By:** androgenic stimulation of genetically predisposed Hair follicles together e` **Aging** role
- **AGA** → very common condition. specially white Races. 90-95% cases

- **Pathogenesis:**

1 Genetic determination:

- Autosomal Dominant - inheritance
- Polygenic
- female less likely to have strong family history

2 Androgen:

- Baldness doesn't develop in males Before puberty.
- Develop after testosterone. adminstration
- Only in those who were genetically predisposed
- in some women → even grossly abnormal levels of androgen → Cause No clinically significant Baldness
- all such ptn are necessarily hirsute.

3 Aging:

- There is progressive extension of area of Baldness with aging

* Suspected genes polymorphisms:
  - androgen Receptor Gene
  - Gene Coding for 5α-Reductase enzyme.
  - Insulin gene
  - Aromatase gene
* There is No Rise in androgen in AGA and normal male and female levels of androgens are sufficont to Cause the hair loss in those genetically predisposed.

• Changes in hair Cycle dynamics:

1- Duration of anagen ↓↓ è each cycle.
2- Length of telogen → constant or prolonged
3- Resultin → Reduction of anagen : telogen Ratio
4- è the successive shortening of hair Cycle → The anagen Duration Become So short that growing hairs fail to achieve sufficient Length To Reach the surface of the skin
↓
Having empty follicular pore.

• Hair follicle miniaturization:

- Androgen targets → Dermal papilla Leading to → follicular miniaturization and hair cycle changes
- Smaller follicles → Result in finer Hairs → followed By → Reduction in pigment production

• Diagnosis:

1- Family History + examination
2- Trichogram - Scalp Biobsy :
↳ normal total number of follicles
è ↑↑ proportion of telogen hair s
↳ Reduction in size of affected follicles
Resultin:- ↓↓ in Diameter of Hairs produced.
3- Lab test :-
for androgen excess in female

→ Terminal : vellous Hair Ratio → Reduces From 8:1 to <4:1
→ Anagen : telogen hair Ratio → Reduces From 12:1 to 5:1
→ association Between AGA and CVS Risk Factors was found.

• Clinical Features:

Males

- Start: Bitemporal Recession
- Followed By: Balding of the Vertex
- Sparing: posterior + lateral scalp margin

- Stages: Described By Hamilton

Females

- AGA in women "Female-pattern Hair Loss"
- Start: later in life
- less severe
- Diffuse Rather than Patterned (thining)
- affecting: frontovertical area of the scalp
- Retains the frontal Hairline w/s male
- widening of the Central Pait "Christmas tree"

• Grading: By Ludwig classification:

- according to Central pait width compared to occipital width:

G I	G II	G III
minimal widening	moderate Thining	significant Thining + widening

• Female Androgenic Alopecia of Male pattern "FAGA-M"

- occur in the following
  - persistant adrenarche Syndrome
  - Adrenal - Ovarian tumoral Alopecia
  - post- hysterectomy Alopecia
  - Involution Alopecia: D.t skin atrophy & Aging

• treatment:

① Systemic Antiandrogens:

- For women as hirsutism

Finasteride:

1 mg/d → for → male pattern hair loss
2.5 mg/d → female pattern hair loss
5 mg/d → è High grade prostatic Carcinoma

- Stops Hair Loss in 90% of ptn for 5 ys
- Regrowth in 65%
- used Continuously to sustain Regrowth
- A study: 1% finasterid topically vs finasterid tablets for AGA Show: Both have Similar effect

② Topical:

1- Minoxidil 2% "Regaine"

- potent vasodilator
- effective orally For hypertension
- when applied topically: 1 mL - twice Daily regiemen"

→ 2% Solution in alcohol and water Base Containing 10% propylene glycol

→ ↑ Cutaneous Blood Flow to scalp
→ Act as biologic response modifier.
↓
leading to: Conversion of Vellous to terminal Hair in 30% of ptns.
→ Possesses a direct effect on the demal papillae and on hair matrix cells

→ The Best Responders are: the youngers who had smaller (<10 cm) area of alopecia with Recent onset

→ Regression: occur after stoppage of treatment within 3 months → to the State Before ttt So Application is Forever

→ minoxidil 2% → approved for: women - men
→ 5% → for men only -

But Now there is Women's "ROGAINE" 5% Aerosol once daily for Female pattern loss

→ once daily 5% minoxidil Foam → is effective as twice daily 2% solution in ♀ e androgenic alopecia

2- Tretinoin:

- tretinoin enhances the trichogenic effect of minoxidil

3- Diazoxide (vasodilator)

Omexin (angiogenesis)

topical cyclosporin:

4- Prostaglandin analogues:

Topical 0.1% Latanoprost
- significant ↑ in hair density
- for both terminal and vellus hairs on the Latanoprost-treated site → when compared to Baseline

Injection 0.3% Bimatoprost
- scalp injections
- weekly for 12 wks
- Then biweekly for 4 weeks

5- Platelet rich plasma injection:

- simple, cost effective, feasible tte optns for androgenetic alopecia

(3) Light therapy: "655 nm / red light" "Laser Comb"

- hairbrush-like device
- approved to promote hair growth in males and females
- Effect: ↑ vascular circulation - ATP production So enhancing Matrix Cell proliferation.

(4) Cosmetic surgeries: - Hair transplantation - Scalp reduction

(5) Cosmetic methods:

- wigs - hair pins
- Camouflage (tinted powder-spray)
- Toppik (Keratin Based fibers adhere to scalp + existing hair)

Post-operative pressure-induced Alopecia:

1. lengthy surgical operation (prolonged contact c operating table)
2. Sustained blunt Trauma to scalp

Trichotillomania

- **D.F**: psychological Disorder → in which the individual have habit of twisting the hair around his finger and pulling a bunch of hairs out.
- more in females (5:1), children
- ptn → Deny plucking hair
- History → ∃ emotional stress

- **Clinically**:
  - ill-defined patch in one frontoparital Region → on which → Hairs are twisted and Broken at various distances from the Clinically normal scalp.
  - other less common sites:
    - ↳ eyeBrows ↳ eyelashes
    - ↳ pubic area.
- **Trichophagy**: - Chewing and swallowing of the hair that pulled out → intestinal obstruction

- **Pathogenesis**:
  - it's grouped under: Impulse control disorders not elsewhere classified causing Clinically Significant Stress or impairment

- **DSM-IV diagnostic Criteria for trichotillomania**:

1- Recurrent pulling out of one's hair → noticeable Hair Loss
2- ↑ sense of tension immediately Before pulling out the hair — or when attempt to resist Behavior
3- Pleasure-gratification - relief → when pulling
4- its Not mental disorder or Not Duets general medical Condition
5- Clinically: marked distress or impairment in: occupational - Social - or other areas of functioning

- **The problem may be**:

1. mild habit 2- Impulse control disorder 3- personality disorders 4- Body dysmorphic Disorder

- **Lab evaluation**: Not Required.
- **Trichogram**:

In the affected area -
↓↓ number of telogen hairs
2ry trichodystrophies & fractured Distal ends
In the unaffected area: Normal

- **Hair growth window**:
- Steady ↑↑ in hair density → noted in shaved area.

- **Histopathology**:
- Distorted follicular anatomy (in absence of inflammation)
- Multiple Catagen Follicles
- perifollicular Hemorrhage
- Pigment casts and Keratin plugs" Trichomalacia"

- **Differential Diagnosis**:

Scaly ringworm	Alopecia areata
-in trichostillomania → No scaling	- in trichotillomania → No exclamation point Hairs
- Fungal Culture → -ve	

- **treatment**:
- Psychiatric counseling
- with minor - or - major - tranquilizer
- N-acetylcysteine → glutamate modulator

-Can be effective in Reducing symptoms.
it act By: Restoring the extracellular glutamate Concentration in the nucleus accumbens → ↓↓ its level which is Responsible for: Pathogenesis of Compulsive behaviors.

Temporal triangular Alopecia

- congenital - appear at Birth.
- non scarring triangular Shaped alopecic Patch.
- temporal scalp

Alopecia areata

- **D.F:** common skin disorder
  - affect Both sexes-

- **Etiology:**

① **Genetic Factors:**

1. Family History in 20%
2. associated ē Congenital Diseases
   - → Down syndrome
   - → Vogt-Koyanagi syndrome.
   - atopy
3. HLA-DQ7 , DQ3 , DR11 → Susceptibility HLA markers for all forms of AA.
   HLA DR4 , DQ7 → marker for Sever Longstanding alopecia totalis / universalis

② **Immunological Factors:**

- Autoimmune Disease (melanocytes associated antigens)
- Autoimmunity → suppoited By the association with autoimmune Diseases:
  - LE - Vitiligo - pernicious anemia
  - Thyroid diseases
- The presence of Autoantibodies in some diseases
  - → Thyroid autoantibodies
- Presence of lymphocytic infiltrate (T-helper) in and around hair follicles ē LCs in bulbar region
- peripheal Blood → ↓↓ Circulating T-suppresor Cells with normal T-helper cells

③ **Emotional stress:**

④ **Hormonal Fluctuation, infectious Agents, Vaccinations**

⑤ **Deficent of Vitamin D:** - recently found in ptn ē AA ē inverse Correlation ē ♂ Disease Seveirty

⑥ **↑↑Bilipid peroxidation** ē defective superoxide dismutase activity found in AA

• Hair follicle growth cycling modulation in AA:

- Exogen → is the controlled shedding of club hair fibers.
- in healthy individuals → shedding normaly occur During anagen growth phase → as new hair fibers produced
- In the Development of Alopecias → exogen occurs in advance of renewed anagen growth → leaving a hair follicle Devoid of visible hair fibers "State called " Kenogen"

• Forms of disruption of the Hair growth Cycle in AA:

1- Anagen phase become inflamed-and maintained in dystrophic Anagen state → unable to produce hair fibers of significant size or integrity

2- Hair Follicles → forced into telogen phase → then cycle through multiple Anagen-telogen phases of brief Duration

3- when AA is Chronic → The hair follicles tend to persist in prolonged telogen phase without an apparent attempt to Return to an anagen growth phase

• Hypothesis for AA development

- normal Anagen hair follicle KCs lack MHC I-II → so they are immunologically privileged
- Hair follicle immunoprotection is transient
  - ↳ limited to anagen growth cycle stage.
- Regression of the hair follicle in Catagen → involves:
  - → Significant apoptosis
  - → Immune cell infiltration
- This Normal hair follicle cycling event → Continuosly expose the immune system to Low levels of hair follicle derived antigens leading to → autoimmune Reaction

• Histopathology:

- ch.ch: presence of miniature hair structures of Eaily Anagen or telogen
- peribulbar lymphocytic infiltrate → "Swarm of bees" Seen mainly of T-helper Type with
- CD_4/CD_8 ratio → Higher in: Clinically active Disease.
  ↓
  ch.ch the Acute phase of AA.
- According to the Disease Stage:

in early, Severe, Progressive disease	Long-Standing OR Stable disease
- normal total number of Hairs - ↑ number of Catagen and telogen Follicles - mononuclear Cell Infiltrate around the bulbs of some terminal anagen and Catagen hairs - Some hair matrix changes - Trichomalacia + marked narrowing of Hair Shaft	- normal - near normal numbered Hair follicles But All miniaturized. - Majoity of Hairs → Catagen - telogen phase - peribulbar infiltrate ↓ Scanty + miniaturized "arrested anagen hairs"

• Clinical features:

- Sudden · Complete loss of Hair in Circumscribed area → in which Skin is Totally normal
- "Exclamation-mark hairs":-
  Thin proximally - Thick distally → Can be easily Pulled out,
  - may present around the patch of AA → indicating: progression of the patch.
- Regrowth at first line & un-pigmented
- The hair gradually resume their normal Caliber and color.
- "ophiasis" Extension of AA along the Scalp margin → which is progressive
- "Alopecia totalis" :-
  Total Loss of Scalp hair
- "Alopecia Universalis" Total Loss of All Body hair
- "Reticular variant:"
  Recurrent Patchy Disease, Hair Loss in one area and spontaneous regrowth in other area.

"Alopecia areata incognita" "Diffuse"

- Rare form of AA
- Predominantly in young women
- The typical patchy distribution of Hair Loss of classic AA → Absent
- Abrupt + intense hair Loss → ch.ch
- clinical picture → Resembles That of telogen effluvium

"Acute Diffuse and total Alopecia"

- new variant of AA
- Rapid progression and extensive involvement
- Absence Favorable prognosis
- Can be misdiagnosed as telogen effluvium

• Site:

Scalp = commenest > Beard, Moustache.

• Trichogram:

- normal or telogen hair root pattern
- if progression is Rapid → it is Telogen dystrophic

• Association:

① Atopy: affect the prognosis

② Nail changes:

20%. • pits • Longitudinal ridging • Thickening the intensity of which parallels that of Hair loss

③ Eye changes: Cataract in alopecia Totalis

• Course and prognosis:

- Variable and unpredictable.
- The Duration & initial attack → < 6 months in 33% of ptn, < 1yr in 50% of ptn.
- 33% of ptn → never Recover.
- The incidence of Relapse 85%
- The Extent of AA involvement → is the most important prognostic factor

• Bad prognostic sign:

1. AA & Atopy
2. Ophiasis
3. Multiple lesions
4. presence of exclamation marks
5. Affection of Eye Brows
6. Nail changes

• treatment :

(A) Topical therapy :

1. Topical or intracutaneous injections of **Steroids**

Topical
- Topical midpotent Corticosteroid
- ☆ of choice in children
- 0.05% Clobetasol propionate ointment under occlusion.
- in alopecia totalis
- alopecia Universalis

intralesional
- By dermojet
- e.g: Triamcinolone suspension
- may produce Complet hair regrowth
- 5 mg/ml → to Scalp
- 2.5 mg/ml → to Face.
- every 4-6 weeks
- stop if No improve after 6 months

2. Non-specific irritants :
- Anthralin 0.5% to 1% short contact Therapy → equals parts of:
  - tincture Iodine
  - Tr. Capsicum
  - Tr. Cantharides

(35)

3. Topical immunotherapy : e.g: dinitro-chloro-benzone (DNCB) OR di-phencyprone (DPCP) ← squaric acid dibutyl ester
- alternative in ptn who don't Develop allergic Reaction to DPCP. → stoped if No improve after 6 mnths

4. photochemotherapy : (PUVA), Excimer laser, Infrared irradiation, Fractional photothermolysis

5. Minoxidil 2-5% solution

6. Topical Cyclosporine :

7. Capsaicin

8. Prostaglandin analogues → Latanoprost, Bimatoprost 0.03%.

9. Bexarotene :

10. Topical Calcineurin inhibitors : unscoplut

11. platelat Rich plasma :
- ↳ PRP ↑↑ hair regrowth significantly
- ↳ ↓↓ hair Dystrophy, Burning, Itching Sensation

Better Compared è TrA (Triamcinolone acetonide)

Def: its a preparation taken from ptn's own Blood in which platelats are enriched in concentrated plasma, platelate which coagulate wounds
- Platelate when activated → Secrete ← Cytokines, growth factors
- in Hair: → Stimulate human dermal papilla cells.
  - ↳ ↑ Survival of hair follicle cells (anti apoptotic effect)

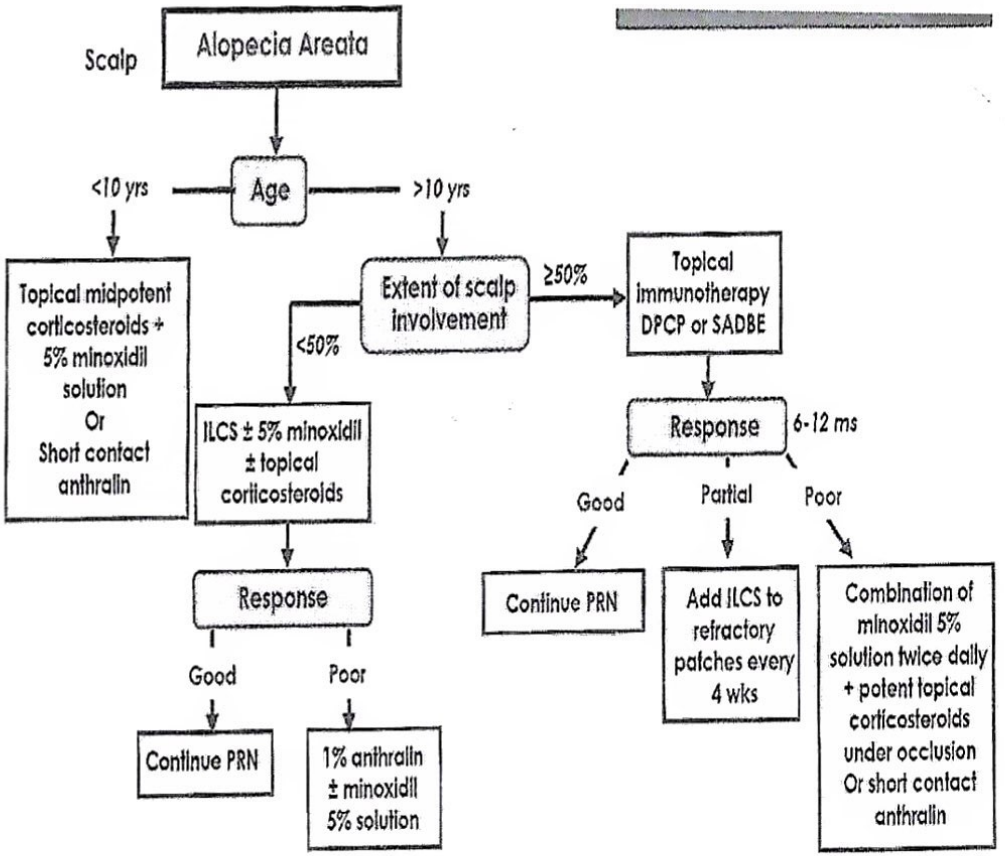
B) Systemic therapy:

- systemic steroids → the only disease arresting treatment via arresting the underlying inflammatory process.

-its use is reserved for the Rapid onset or rapidly progressive extensive active AA

- Oral prednisolone → 0.5 - 0.8 mg/kg slowly tapered over 2 months
  Not exceeding 3 months
- pulsed systemic Corticosteroids:
  (pulsed oral or I.V)
  - pulsed oral prednisolone 5mg/kg/mnth for 3 mnths
  - pulsed I.V methylprednisolone.

  Risk of : hypokalemia - Cardiac arrythymia
  → Careful ptn monitoring
- Systemic Cyclosporine:
- Methotrexate : ± Low Dose prednisone
  → Sucess in the AT - AU
- Biologics: etanercept - adalimumab
  Infliximab → failed



Treatment algorithm for alopecia areata involving the scalp.

Alopecia in LE

Chronic DLE:

- Cicatricial alopecia & histopath. and DF → suggest DLE
- pseudopelade Type.

Acute SLE:

- lab test of SLE → +ve

Telogen effluvium	Anagen effluvium
-Diffuse hair Loss several months after Severe flare of SLE	-patchy or Diffuse hair Loss → few weeks after a disease flare Begun
-Biopsy → Telogen effluvium	-Biopsy = AA

Examination:

- Diffuse or patchy (moth-eaten) - Non Scarring non-inflammatory alopecia
- moth eaten Alopecia → Can also occur in AA, SLE

Investigations:

- Serological test for syphilis
- Histopathology → 3 patterns
  1. Features of 2ry Syphilis & papulosquamous lesions
  2. Features of telogen effluvium.
  3. Features of AA
- Hair-pull test → ↑ No. of telogen Hairs
- Hair-pluck test → ↑ telogen Count

Syphilitic alopecia

Two Types:

1- Symptomatic: & lesions of 2ry Syphilis on Scalp or elsewhere

2- Essential: Sign of latent Syphillis and other Cut. lesion → alopecont

Drug induced associated Alopecia

- Diffuse - non-Scarring - reversible alopecia
- most Commonly involving Scalp

Mechanism:

1) Direct effect on the follicle through:

[a] Interruption of anagen growth (anagen effluvium)

- common Complication of Cancer Chemotherapy
- Sudden occur within Days - weeks of Drug administration

- ils severe - affecting Most of scalp hair
- The high mitotic activity of Hair follicle cells → make them profoundly susceptible to Cytotoxic agents

[b] premature precipitation of telogen

[c] Androgenic induction:
- of normal terminal hairs to vellus hair in genitically predisposed individuals.
- e.g: androgenic progesterone.
  exogenous androgens
  anabolic steroids

II) indirect effects è Drug-induced Systemic Disorders:

e.g: lichenoid eruption Complicated By Cicatricial alopecia OR Toxic Epidemal necrolysis

Drugs Cause Anagen effluvium:

↳ Anticancer agents:- Bleomycin - Cyclosporine - Dactinomycin - Hydroxyurea - MTX
↳ Colchicine :-

Cancer Can Cause 2 forms of Hair loss

[1] telogen effluvium: D.t metabolic, emotional stress - severe debilitating illness
[2] Anagen effluvium: D.t chemotherapy OR Radiotherapy, occur within weeks of ~~tt~~

DD of Dermatoses of scalp

[I] Hairy scalp (no hair loss)

↳ (a) non-erythematous papules-plaques :-
1- since Birth → organoid nevus
2. after puberty → pilar cysts / intradermal nevus
3. After 40 yr → seborheic keratosis

↳ (b) pustules, crusts, Exudation
1- Contact dematitis → scalp-neck. forehead
2- pediculosis → scalp
3- Kerion → Localized Boggy swelling in children
4- Acne keloid → nape of neck
- Acne necrotica

↳ (c) Itching - Scaling è oredout Erythema
pediculosis - psoriasis - Seb. Dermatitis

[II] Hair loss

↳ (a) non-Cicatricial
- Congenital
- Acquired:
  ↳ Diffuse
  ↳ Circumscribed

↳ (b) Cicatricial

Abnormalities of Hair shaft

1 Fracture of Hair shaft:
- transverse
- Oblique
- Longitudinal

Trichorrhexis Nodosa TN

- Small beaded swelling along the hair shaft → transverse fracture
- Congenital . aquired from Physical Damage:
  - shampoo . Dyes
- Clinically: hypotrichosis
  - Alopecia
  - Hair fails to achieve any length.

★ **Congenital**: seen in
- trichothiodystrophy → Brittle, sulfur-deficient hair + Ichthyosis
  - part of IBIDS syndrome: Brittle hair, Intellectual impairment, Decrease Fertility, Short Stature
- arginosuccinic aciduria.
- Netherton's syndrome
- menkes disease.

★ **aquired**: 3 Types:
- Proximal in Blacks
- Distal in whites
- Localized in patches of trichotillomania of Lichen Simplex

Trichoschisis

- transverse fracture across the hair shaft through the Cuticle and Cortex.
- may seen in: trichothiodystrophy

Trichoclasis

- Common "green-stick" Fracture of Hair shaft.
- Consist of transverse fracture of shaft
- Splinted partly or wholly by intact Cuticle

Trichoptilosis

- Longitudinal splitting of distal end of the hair "split ends"

- Trichorrhexis invaginata

- Bamboo-hair
- nodal swelling of hair shaft
- Invagination of distal hair into the proximal portion → producing "Ball + glove" deformity
- Its Due to: Defect in keratinization within the cortex and internal Root sheath
- associated w: Ichthyosis linearis Circumflexa and atrophy in Netherton's Syndrome

- pili bifurcati "pili multigemini

- Two hairs w Same follicle → bifurcate Then rejoin, each branch has its own cuticle

- pili annulati

- Alternating bright and dark Bands seen in hair shaft w reflected light.
- Light Bands D/t abnormal air-filled Cavities with ↑ light reflex - Sporadic or Familial
- normal hair Length.

- Monilethrix "beading of hair"

- elliptic nodes → separated By narrower internodes → non medullated
- Longitudinal grooves over the internodes
- appear in early childhood with brittle Beaded hairs → emerge From keratotic, follicular papules
- the hair fracture easily → alopecia Can be severe
- Point mutation → Found in the hair Cortex Specific Keratain genes KRT86-KRT81
- Mutations Found in the genes That encode

- Pseudomonilethrix

- the hair shaft → irregular-flattened → expanded areas.
- The Cuticle is intact over the nodes and internodes

Bubble Hair

- The involved hair → is straighter and stiffer than normal.
- By light microscopy → The hair shafts → Contain Large - Irregularly spaced "bubbles" → That expand and thin the hair cortex.
- Hair fractures occur at the site of Large Bubble.

• uncombable hair Syndrome "pili trianguli et Canaliculi" "spun glass Hair"

- The hair shaft → triangular in Cross section & Longitudinal grooves

- Represent → diffuse form of straight Hair nevus.
- The hair normal in quantity, Blond Dry, frizzy, Hard, rough to the Touch • Can't be Brushed or combed
- Abnormal keratinization of the → internal Root Sheath is postulated to cause the irregularly shaped Hair shafts :-
  - "triangular shape on cross section"
  - Longitudinal groove → Best seen e' Scanning electron microscopy
- possible improvement e' biotin

• plica neuropathica

- uncommon acquired condition in which groups of hair are matted together to form a malodours, impenetrable, irreversible mass
- pediculosis capitis, scalp inflammation.
- PF:
  - kinky Hair
  - febrile illness
  - Frequent used harsh shampoos
  - psychological disturbances D.t hair neglect
  - poor hygiene → severe infestations e. Resultant → exudates → matting hair

III Hair Shaft coiling + twisting:

Pili torti

- Hair Shaft → flattened + twisted Through 180° around their long axis
- 4, 5 twists → at irregular intervals along the hair shaft → Spangled or Beaded apperance.
- The involved hair: Brittle - Break-off easily - Don't achieve normal Hair length.
- associated e`:
  - Hypohidrotic ectodermal Dysplasia
  - Menke's syndrome
  - Bazex Syndrome (e`BCC - follicular atrophoderma)
  - Bjonstad's Syndrome
  - Crandall Syndrome
  - Netherton's Syndrome

Woolly Hair

- tightly coiled hair in individuals of non-Negroid
- Its normal in most Blacks
- 4 Clinical Types:
  1. Hereditary dominant woolly hair
  2. Familial Recessive woolly Hair
  3. woolly hair nevus: At Birth, Not genetically Determined
  4. Whisker hair:- Short, Curly, Dark hair that grows around the ears in young men

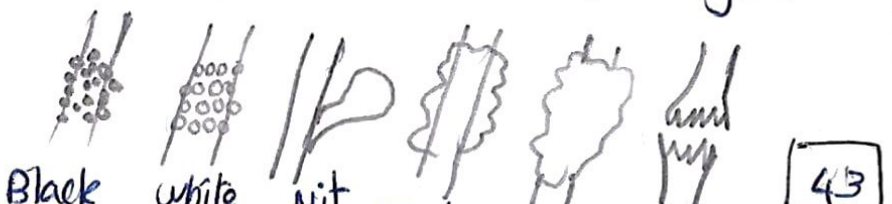
Loose anagen hair Syndrome

- Young-girl e` fairly short Blond Hair That seldom needs Cutting and who has Diffuse or patchy Alopecia without ↑↑ in hair fragility
- Hair-shaft → twists, grooves, Angular in Cross section
- Microscope → ruffled proximal Cuticle absconce of Root Sheath, bent matrix

- Familial Cases → Reported
- the defect Result of → Faulty Cornification of the inner root Sheath
  ↓
  it will interfere è normal interdigitation of the inner root Sheath Cuticle with the hair Cuticle → poor anchoring
- improvement → è age
- DD → telogen effluvium, AA
  → Trichotillomania

IV Extraneous matter on hair Shaft:

- Fungi → Tinea Capitis Piedra
- Bacteria → Trichomycosis axillaris
- Pediculosis: Nits
- peripilar Casts → pseudonits
- Deposits → Lacquer, paint glue.



★ Hair Cast:

Cylindrical Rings OR Keratin → more freely along Hair Shaft, Differentiate from nits
↓ Don't freely Slide off.

★ Changes in Color:

→ chemical structure of melanin, the number size, Shape of melanin granules

→ Congenital: OR D.t exogenous OR endogenous Factors

1- Heterochromia: (various colors in same individual) patchy differences of hair color D.t:
- → Dark hair growing from pigmented nevus
- → Autosomal Dominant heterochromia
- → Somatic mosaicism
- → white forelock of piebaldism
- → Flag → sign of kwashiorkor
- → Exogenous heterochromia

2- Albinism:

3- poliosis: Localized patch of white hair D.t lack of melanin - seen è: vitiligo - piebaldism, Waardenburg syndrome

4- Canities: Diffuse graying - whitening of Hair over time D.t progressive Reduction in melanocyte

• androgen dependant Dermatosis:

- Hirsutism
- AV
- AGA
- Seb. Dematits
- Fox Fordyce
- Becker's Melanosis
- Hidradenitis suppurt

• Causes of Hair loss

A) Non-Cicatrical Alopecia

Congenital

- Progeria
- Ectodermal dysplasia
- Rothmund-T.S
- Netherton S

Aquired

① Diffused

- Telogen effluvium
- Anagen effluvium
- Androgenic Alopecia
- Drugs: anticoagulant
- ↓ Zinc
- Anemia
- Endocrine: DM

② Localized:

- androgenic alopecia
- Alopecia areata
- Trauma
- Ringworm
- Syphilis

B) Cicatricial Alopecia

① Congenital:

- Aplastia Cutis
- Darier disease
- Epidermal Nevi
- porokeratosis

② Traumatic:

Trauma. Burn. Radiation

③ Infection:

Fungal: Kerion - Favus
mycobact: LV - Leprosy
Viral: HZ
Protozoa: Leishmaniasis

④ Tumor:

BCC - SCC - metastasis

⑤ CT:

DLE - DM - morphea

⑥ Others:

LP - CP - PG
acne keloidalis

• Loss outer 1/3 of eyebrows:

- Alopecia areata
- Leprosy
- Myxedema
- Trichotillomania

Hair

- Biology of hair cycle. (2009).
- Trichogram. (2009).
- Investigative procedures for a case of hirsutism. (2008).
- Management strategy of androgenetic alopecia. (2008).
- Hyperhidrosis (2005).
- Diffuse hair fall (2003).
- Anti-Androgens (2002).
- Assessment of diffuse hair falling in a 30 years old female patient (2001).
- The treatment of androgenetic alopecia (2001).
- Hair growth promoters (2000).
- Circumscribed area of loss of scalp hair: discuss how to arrive at the diagnosis of a case of (1994).
- Circumscribed area of loss of scalp hair: discuss how to arrive at the diagnosis of a case of (1994).
- Differential diagnosis of paular lesions on the genitalia (1994).
- Differential diagnosis of popular eruptions on the scrotum (1993).
- How to evaluate a case of erythroderma in an adult (1993 - 1988).
- Androgen dependent dermatosis and comment briefly on their treatment (1991).
- Cutaneous manifestations of malnutrition (1990).
- Actinic chelitis (1989).
- Define dyskeratosis – mention four diseases in which it occurs (1988).
- Enumerate skin diseases associated with gastrointestinal polyposis – describe clinical picture of one of them (1985).
- Circumscribed area of loss of scalp hair: discuss how to arrive at the diagnosis of a case of (1994).
- Draw a cross and longitudinal sections of hair follicle (1984).
- Mention 4 causes of telogen effluvium (1984).
- Differential diagnosis of blistering lesions of the mouth (1993).
- Differential diagnosis of warty lesion on the hand (1993).
- Differential diagnosis of few hyperpigmented patches on the back (1992).
- Skin disorders associated with pregnancy (1992).
- Differential diagnosis of papulo-pustular eruptions on the face (1991).